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Pharmacology and the Exercise Professional: Understanding Implications of Client Medications

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Q: What is the value of having a client provide a list of their current medications? How might medications impact client responses to exercise?

A: Client safety is a key area for an exercise professional. Keeping facilities clean, ensuring equipment is in good working order, and designing appropriately progressed training programs are obvious examples of the aspects that impact client well-being. Less visible, but of vital importance, is screening participants related to conditions and situations that may impact their response to exercise. The preparticipation screening as described by the American College of Sports Medicine (ACSM) is intended, in general, to identify individuals who are at risk for cardiovascular events during exercise (1,2).

Additionally, a health screening questionnaire (also called a health history questionnaire) is helpful to gather information on a client's current health and medical history, including a list of medications they are taking (3). A thorough review of the client's medications allows the exercise professional to consider factors that may affect exercise testing and/or exercise prescription, thus promoting client safety. Knowledge of

medications also may be useful within the screening process as highlighted in Box 1. In this article, examples will be provided of common medication categories and how they may impact a client's response to exercise. Given the variety of medications that may be encountered (see Box 2 for insights on prescription medication use in the United States), resources that an exercise professional can consult to investigate the impact of various medications are suggested, and considerations are presented on how this knowledge of potential medication effects may apply while staying within an appropriate scope of practice.

CONSIDERATIONS WITH EXERCISE: COMMON MEDICATION CATEGORIES

Many medications have the potential to impact physiological responses to exercise—some aspects falling within the intended purpose of the medication, and others as side effects (see Box 3). In this section, select examples illustrate how medications may impact heart rate, blood pressure, blood glucose, muscle and tendons, and hydration. This is obviously not an inclusive list and is intended to highlight how various medications can impact factors related to exercise.



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Box 1: Medications and Cardiovascular Disease (CVD) Risk Factor Assessment

Within the CVD risk factor assessment in *ACSM's Guidelines for Exercise Testing and Prescription* (1), knowledge of medication use is required within the defining criteria for blood pressure and lipids. For example, the positive risk factor for blood pressure is defined by measured systolic blood pressure of 130 mmHg or higher and/or diastolic blood pressure of 80 mmHg or higher (based on an average of 2 or more readings on 2 or more occasions) (1). An additional criterion is if a person is taking an antihypertensive medication. Consider a client who has a blood pressure reading of 120/78, and, based on that information, the client is not considered to have a risk factor related to blood pressure. However, if the client is taking a medication to control blood pressure, then the client would be considered to have a positive risk factor related to blood pressure. Similarly for lipids, in addition to other measures, being on a lipid-lowering medication is included within the defining criteria.

EFFECTS ON BLOOD PRESSURE AND HEART RATE

There are many medications that can reduce blood pressure and/or lower heart rate; some of these medications are intended to treat hypertension (*i.e.*, high blood pressure) or tachycardia (*i.e.*, high heart rate), while others may be used for different indications. There are several classes of antihypertensive medications, including the following: diuretics, beta-blockers, angiotensin converting enzyme (ACE) inhibitors, angiotensin II receptor blockers (ARBs), calcium channel blockers (CCBs), aldosterone receptor antagonists, central alpha-2 receptor antagonists, and vasodilators (3). These medications lower blood pressure using differing mechanisms of action (3,11). Beta-blockers also are known for reducing heart rate, as are some calcium channel blockers (12). Of note, the clinical effect of beta-blockers depends on their selectivity. Beta-blockers that are “nonselective” act at different receptors on the heart and blood vessels to reduce heart rate and blood pressure, as well as on the respiratory system (this can be a concern for those with asthma or other lung conditions); however, beta-blockers that are “cardioselective” act specifically on beta receptors located on the heart to reduce heart rate (of note, this could still result in hypotension [*i.e.*, low blood pressure]) (12).

Blood pressure and heart rate also can be affected by medications prescribed for reasons not related to cardiovascular conditions. For example, psychotropic medications can result in changes in blood pressure and heart rate. Some psychotropic medications are more likely to increase blood pressure, whereas others may decrease blood pressure. This is likely influenced by different effects on the neurochemical pathways (13). The selective serotonin reuptake inhibitors (SSRIs) have limited effects on the autonomic system; therefore, they are least likely to impact blood pressure and heart rate (13).

Serotonin–norepinephrine reuptake inhibitors (SNRIs), such as venlafaxine, and dopamine norepinephrine reuptake inhibitors (*e.g.*, bupropion) are well known for increasing blood pressure and heart rate (13). Contrastingly, norepinephrine–serotonin modulators, such as mirtazapine, can lead to orthostatic hypotension

Box 2: Medications in the United States

The most recent data from the Centers for Disease Control and Prevention provide insight on prescription drug use (for the prior 30 days) in the United States for the period 2017 to 2020 (4). The estimated percent of the U.S. population who use at least one prescription drug was nearly 46.8% (age adjusted), the percent who use at least three prescription drugs was 21.8%, and the percent who use at least five prescription drugs was 11.7% (4). When reflecting on a full year, 68.8% of adults reported taking a prescription medication at any time within the prior 12 months in the year 2023 (5). These percentages highlight the importance of discussing medication use with clients.

Top medication categories in the United States, based on 2021 prescriptions (6,7), included those that target:

- high cholesterol (statin therapies that lower the amount of cholesterol produced by the liver),
- type 2 diabetes (metformin which lowers glucose absorbed from the digestive system or produced by the liver and as well increases the response to insulin),
- high blood pressure (angiotensin converting enzyme inhibitors that help lower the body's blood volume; also, calcium channel blockers that relax blood vessels),
- hypothyroidism (synthetic hormone for use when the thyroid gland is not producing enough thyroid hormone),
- high blood pressure and heart conditions (beta-blockers that block beta receptors on the heart thus lowering cardiac output),
- asthma (adrenergic bronchodilators that act to relax muscles within the respiratory system),
- acid reflux/gastric reflux disease/peptic ulcers (proton pump inhibitors which lower the amount of acid the stomach produces),
- hypertension/kidney disease/heart disease (angiotensin II receptor antagonists that relax blood vessels and reduce water and salt retained by the kidneys), and
- seizure/nerve-related conditions (anticonvulsants that reduce excitability of nerve cells in the brain).

Additionally, weight loss drugs are another category of note; for example, in the list of most prescribed medications in the United States, semaglutide medications jumped from a ranking of 236 in 2019 to 129 in 2020 and in the latest available ranking (for 2022) was listed as the 48th most commonly prescribed medication (8). When looking at the prescription drug expenses, overall, the total is \$722.5 billion in the United States, with semaglutide as the top drug for the overall U.S. market in 2023 (9).

In addition, nonprescription, over-the-counter medications also can affect blood pressure and heart rate. Sympathomimetics,

EFFECTS ON GLUCOSE LEVELS

Medications used to treat diabetes (type 1 and type 2) are intended to maintain blood glucose levels within an appropriate range. These medications may be associated with hypoglycemia (*i.e.*, low blood glucose). Insulin is one of the most common



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Box 3: Indications and Side Effects of Medications

Exercise professionals should be aware of how medications work related to a particular disease or condition (*i.e.*, the therapeutic indication) as well as potential side effects (*i.e.*, responses caused by a medication other than the intended therapeutic effect which can be harmful, beneficial, or neutral) (10). Either may result in situations that impact clients when physically active. For example, beta-blockers are intended to lower heart rate, and thus the use of an estimated heart rate based on age is not appropriate in a training setting. At times a medication may result in a concerning response. For example, the purpose of insulin injections for an individual with type 1 diabetes is to promote glucose uptake from the blood into the target cells. However, a common side effect is hypoglycemia (when blood glucose is too low)—a situation where the dosage is more than required to maintain normal glucose levels. Side effects also can include symptoms that can develop that are not related to the intended purpose. For example, statin medications are prescribed to lower cholesterol but have a side effect of muscle problems (*e.g.*, muscle pain or even, at the most severe, rhabdomyolysis).

medications used to treat diabetes; the risk of hypoglycemia is high with this medication as well as a class of medications known as sulfonylureas (12). Other antidiabetic medications have a low incidence of hypoglycemia unless they are combined with agents like insulin or sulfonylureas. In these situations, the risk of hypoglycemia is increased (*i.e.*, additive blood glucose lowering effects) (12). These include the following classes: biguanides (metformin), thiazolidinediones, sodium-glucose cotransporter-2 (SGLT2) inhibitors, dipeptidyl peptidase 4 (DPP-4) inhibitors, and glucagon-like peptide 1 receptor agonists (GLP-1RA) (3). Note that GLP-1RAs not only help to lower blood glucose but also can lead to weight loss. Some GLP-1RA medications not only have approval for treatment of type 2 diabetes, but also, with diet and physical activity, are FDA approved for chronic weight management (12). For example, semaglutide (generic name) is a GLP-1RA; Ozempic[®] is FDA approved for treatment of type 2 diabetes, while Wegovy[®] is approved for weight management (12). Other GLP-1RAs include tirzepatide (Mounjaro[®] for type 2 diabetes and Zepbound[®] for weight management) and liraglutide (Victoza[®] for type 2 diabetes and Saxenda[®] for weight management) (12).

Corticosteroids can be used to treat many conditions. They are widely prescribed for their anti-inflammatory and immunosuppressive properties (17). There are several side effects associated with the medication class, but hyperglycemia (*i.e.*, elevated blood glucose) is one of the most common (17). Additionally, psychotropic medications commonly used to treat schizophrenia or bipolar disorder, second-generation antipsychotics (SGAs), such as clozapine or olanzapine, are well known for their metabolic side effects which include hyperglycemia (18).

EFFECTS ON MUSCLES/TENDONS

Statins are some of the most effective agents for treating high cholesterol (3). One of the more notable side effects associated with statins is muscle symptoms typically referred to as statin-induced muscle symptoms (SAMS) (*e.g.*, myalgia [muscle aches], myositis [muscle inflammation], and in severe cases rhabdomyolysis [muscle breakdown]) (3,19). SAMS is different than muscle soreness induced by exercise. However, SAMS is difficult to diagnose because the time from statin initiation to symptoms, the type of complaints, and the severity varies among individuals, and there is no confirmatory diagnostic test (19). Additionally, of the few studies designed to assess statin-induced muscle pain, actual prevalence is confounded because a large portion of SAMS could be due to nonspecific muscle pain and not directly related to statin use (19). If an individual complains of muscle pain that persists, especially without exercise, and is taking a statin, recommend discussing this with their doctor as there are treatment strategies to mitigate these symptoms.

Other medications can impact tendons. Antibiotics are used to treat many different types of infections. One specific class of antibiotics, fluoroquinolones, can increase the risk of tendon injuries, in particular the Achilles tendon (20). Although rare, given the risk of tendinitis and tendon rupture, a warning was added to prescribing information of this risk and individuals taking this medication should contact their doctor immediately if they experience tendon pain or inflammation (20).

EFFECTS ON HYDRATION

The exercise professional should be aware of medications that may impact hydration levels. Diuretics (*i.e.*, loop diuretics, thiazide-type diuretics), sometimes referred to as “water pills,” rid the body of excess salt and water through urination and reduce blood pressure (11). With this, they can cause profound diuresis (*i.e.*, increased urination) resulting in fluid and electrolyte depletion (12). Diuretics also can reduce thirst sensation, which is another consideration for causing dehydration (21). In some cases, physicians may prescribe electrolyte supplementation to prevent/treat electrolyte deficiency caused by diuresis.

Other medications also require extra attention to hydration. Lithium, a mood stabilizer, commonly used to treat bipolar disorder is associated with adverse effects, such as increased urination (12). As with diuretics, this can lead to dehydration (12). Maintaining hydration while taking lithium is important as dehydration could lead to lithium toxicity (12). SGLT2 inhibitors, prescribed for use with type 2 diabetes, rid the body of excess glucose by causing increased urination; therefore, it is important to maintain hydration while taking these medications (12).

Over-the-counter medications, such as laxatives (*e.g.*, Miralax[®]), can lead to gastrointestinal disruptions (*i.e.*, diarrhea) that may contribute to dehydration. Other over-the-counter medications, such as Fioricet[®] (used to treat tension headaches) or Excedrin[®] (used for headache and migraine relief), contain caffeine (12). Caffeine is a known diuretic that could lead to dehydration (22). The U.S.

Food and Drug Administration (FDA) suggests caffeine has diuretic properties and advises its users to drink extra water to avoid dehydration during exercise in the heat (22) (Table).

MEDICATION INFORMATION: SOURCES FOR EXERCISE PROFESSIONALS

Exercise professionals are certainly not expected to have memorized all medication names and physiologic effects but should establish avenues to access needed information. Care must be taken to ensure sources are reputable and unbiased. Some free access websites/apps for exercise professionals to consult include the following:

- Drugs.com
 - Provides information on prescription drugs and over-the-counter medications
- DailyMed: dailymed.nlm.nih.gov
 - Provides labeling for FDA-approved products, including prescription and nonprescription drug and biological products
- Drugs@FDA: accessdata.fda.gov/scripts/cder/daf/index.cfm
 - Provides information on FDA-approved prescription and over-the-counter drugs
- MedlinePlus: medlineplus.gov/druginformation.html
 - Provides information on prescription and over-the-counter medications as well as dietary supplements and herbal remedies

In addition, contacting a local pharmacist, or even the drug manufacturer (medical information phone number should be available on company websites), can be helpful in determining how a given medication may impact a client within an exercise setting.

EXERCISE TESTING/PRESCRIPTION: A CASE SHOWING THE IMPORTANCE OF MEDICATION REVIEW

A careful review of all medications is an important preliminary step when working with a client. Avoid making any assumptions based on a client's age or apparent health; many medications can impact physiologic responses and may be used for conditions that do not appear to have a relationship with exercise.

Consider the following case: a 30-year-old female at ABC fitness center would like guidance on setting up an aerobic exercise program of moderate intensity. She has a heart rate monitor and is interested in using heart rate to gauge her intensity. Having completed the health screening questionnaire and other necessary documents, she meets with an exercise professional to determine what heart rate range would be appropriate. Based on the *ACSM Guidelines*, 64% to 76% of heart rate max is suggested for moderate intensity (1). An estimated maximal heart rate is calculated based on her age (for simplicity in this example, 220 – age is used; for more information on estimation of maximal heart rate see “Estimating Maximal Heart Rate” (23)). This results in an estimated maximal heart rate of 190 (calculated as 220–30 = 190) and a suggested range of 122–144 beats per minute

TABLE: Select Physiologic Responses and Examples of Medication Class Effects (12)

Areas of Potential Impact	Medication Class	Effect
Effects on blood pressure	Diuretics	↓
	ACE inhibitors	↓
	ARBs	↓
	CCBs	↓
	Central alpha-2 receptor antagonists	↓
	Vasodilators	↓
	Aldosterone receptor antagonists	↓
	Mirtazapine	↓
	Beta-blockers	↓ (dependent on selectivity)
	SNRIs	↑
	TCAs	↑/↓
	Stimulants	↑
	NSAIDs	↑
	Beta-2 agonists	↑
Effects on heart rate	Sympathomimetics	↑
	Beta-blockers	↓
	CCBs	↓
	Central alpha-2 receptor antagonists	↓
	Stimulants	↑
	SNRIs	↑
	TCAs	↑ (varying occurrence)
	Beta-2 agonists	↑
Effects on glucose levels	Sympathomimetics	↑
	Antidiabetes medications	↓
	Corticosteroids	↑
Effects on muscle/tendons	SGAs	↑
	Statins	↑ risk of muscle problems (i.e., rhabdomyolysis)
Effects on Hydration	Fluoroquinolones	↑ risk of tendon rupture
	Diuretics	↓
	Lithium	↓
	SGLT2 inhibitors	↓
	Laxatives	↓
	Caffeine	↓

ACE, angiotensin converting enzyme; ARBs, angiotensin II receptor blockers; CCB, calcium channel blockers; SNRIs, serotonin–norepinephrine reuptake inhibitors; TCAs, tricyclic antidepressants; NSAIDs, nonsteroidal anti-inflammatory drugs; SGAs, second-generation antipsychotics; SGLT2 inhibitors, sodium-glucose cotransporter-2 inhibitors.

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(calculated as $0.64 \times 190 = 122$ and $0.76 \times 190 = 144$) for moderate intensity aerobic activity. However, a careful review of her health screening questionnaire reveals she is taking propranolol for prevention of migraines. Propranolol is a beta-blocker, a type of medication that is commonly used to treat high blood pressure or other heart conditions. Regardless of the reason for the prescription, the medication will influence heart rate (lower at rest and during exercise) and blood pressure (lower at rest and during exercise). Given the client is apparently healthy and reported no cardiac concerns, only a careful review of her medications by the exercise professional helped to avoid providing an erroneous target heart rate range. Since she is taking a beta-blocker, estimation of maximal heart rate based on her age would be too high as beta-blockers lower heart rate at rest and during exercise, resulting in the calculated target range also being at a higher than intended intensity. In this situation, since a measured heart rate max is not available, use of a rating of perceived exertion might be considered to guide intensity (3).

SUPPORTING CLIENTS WHILE STAYING WITHIN SCOPE OF PRACTICE

In a recent meta-analysis, nearly 43% of individuals were nonadherent to prescribed medications (within the studies included in the analysis the range was 16.4% to 61.4%) (24). Realizing there are many potential facilitators that influence adherence (*e.g.*, understanding of the disease and medication, support from significant others, coping with side effects, good communication with healthcare providers (25), exercise professionals can be supportive, while remaining within their scope of practice.

Exercise professionals are obviously not able to prescribe medications, nor should they recommend medications or suggest changes in dosage or type of medication; exercise professionals should not provide medical advice or medical opinions (*e.g.*, that taking a particular drug will provide a desired outcome). While staying within an appropriate scope of practice, clients can be encouraged to contact their healthcare provider regarding medication-related questions or concerns.

For example, a client with type 1 diabetes who has developed a regular program of physical activity has been routinely experiencing hypoglycemia that in the short-term is being addressed by consuming “emergency” carbohydrate (in this case, a glucose-containing beverage). Rather than continuing to experience low blood glucose and add unwanted calories, the exercise professional can explain to the client how exercise influences the uptake of glucose from the blood into the working muscles. Although in general this is a normal physiologic response, for someone who is taking insulin (which also promotes uptake of glucose into target cells), blood glucose levels can drop excessively. It would not be within the exercise professional's scope to give suggestions or directions to the client on changing their insulin dosage. Instead, the client can be encouraged to consult with their physician or endocrinologist regarding the hypoglycemia they are experiencing and their current insulin use. The exercise professional is thus able to support the client by educating them

Additional Resource for the Reader

The following book provides the reader with more information pertaining to medications from five clinical areas (cardiovascular, pulmonary, metabolic, orthopedic, and neuromuscular) for those interested in learning more.

Thompson WR, Ozemek C. *ACSM's Clinical Exercise Physiology*. 2nd Ed. Philadelphia (PA): Wolters Kluwer. 2024. ISBN 9781975234690.

Learn more about this book here:

<https://www.acsm.org/education-resources/books/clinical-exercise-physiology>

on the role of exercise on glucose uptake and recommending the client discuss any potential adjustments in their insulin plan with their healthcare provider.

CONCLUSIONS

Recognizing the prevalence of medication use and appreciating the potential impact of many medications on exercise response, exercise professionals can promote safe and effective exercise testing/prescription with a careful review of current medications. Reviewing the client's list of medications provided on their health screening questionnaire and using reputable sources will enable the exercise professional to be aware of potential considerations and concerns related to specific medications. Exercise professionals must remain within an appropriate scope of practice, not providing medical advice or medical opinions, and instead refer clients to their healthcare provider as needed.

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